SYSTEM OF, AND METHOD FOR, INDIRECT LIGHTING

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[01] The present invention relates to lighting, specifically to an indirect lighting fixture.

DESCRIPTION OF RELATED ART

[02] While different types of electrical light sources exist, one major type of electrical light source is a linear source, such as a tubular fluorescent lamp. Typically, such a lamp is mounted overhead and provides direct light to illuminate an area. As direct light can produce a glare and be relatively harsh, the emitted light can be modified through diffusion or refraction to lessen the glare and harshness. An alternative method of illuminating an area with a linear source is to direct some of the light upward from a position below the ceiling so as to provide illumination from the reflection of the light off the ceiling. Such indirect lighting fixtures tend to provide a more even and natural looking illumination without the harsh glare of direct lighting.

[03] A problem with indirect lighting fixtures is that such fixtures often produce localized areas of brightness and observable shadows on the ceiling and thus do not provide a relatively uniform light distribution pattern. One solution to minimizing the areas of brightness and the casting of shadows is to suspend the indirect light fixture farther from the ceiling. The increase in distance softens the change in light intensity, thus making patterns of brightness and shadows on the ceiling less noticeable. However, such fixtures may not be preferred for installation in low ceiling applications where the distance of suspension from the ceiling can create clearance problems for adults and may otherwise create an undesirable appearance.

[04] In an attempt to provide a fixture suitable for a low ceiling application, some light fixtures use reflectors, often with complex geometry, to shape the light distribution.

While sometimes providing acceptable results, often such light fixtures require a substantial thickness in the light fixture to shape the light into an acceptable light distribution. The increase in size of the light fixture tends to increase both the weight and expense of the fixture while also making it less suitable for low ceiling applications.

BRIEF SUMMARY OF THE INVENTION

[05] One aspect of the present invention is a compact, low profile indirect light fixture with a light shield that is suitable for installation on a ceiling and can be used in low ceiling applications. In an embodiment, the light shield has a plurality of coverage zones with a varying light blocking area. In an embodiment, a percentage of the light can pass through the light shield of the coverage zone closest to the center of the light shield and an increasing percentage of light can pass through a subsequent coverage zone located near the outer edge of the shield. In an embodiment, the resultant light distribution provides a pleasing pattern on the reflective surface without distracting shadows or bands of light. In an embodiment, the light passing through the shield increases between a perpendicular angle and an offset angle corresponding to the angle of the main beam. In an embodiment, the light passing through the shield at the perpendicular angle is some percentage less than the light passing through the shield at the offset angle corresponding to the angle of the main beam.

BRIEF DESCRIPTION OF THE DRAWINGS

[06] The present invention is illustrated by way of example and not limited in the accompanying figures in which like reference numerals indicate similar elements and in which:

[07] Figure 1 illustrates a perspective view of an embodiment of a light fixture of the present invention.

[08] Figure 2 illustrates a simplified exploded view of the embodiment depicted in Figure 1.

[09] Figure 3*a* illustrates a plan view of embodiment pictured in Figure 1.

[10] Figure 3*b* illustrates a front view of the embodiment pictured in Figure 3*a*.

[11] Figure 4*a* illustrates a cross-sectional view of the embodiment depicted in Figure 3*a*, along the lines of 4-4.

[12] Figure 4*b* is a simplified cross sectional view of the light source and shield as depicted in Figure 4a.

[13] Figure 5 illustrates a partial plan view of an embodiment of a light shield.

[14] Figure 6 illustrates a partial simplified plan view of an embodiment of a light shield and visible portions of a light source depicted in Figure 1.

[15] Figure 7 illustrates a partial simplified plan view of an embodiment of the light shield and visible portions of a light source depicted in Figure 1.

[16] Figure 8 illustrates an alternative embodiment of the light shield and light source depicted in Figure 7.

DETAILED DESCRIPTION OF THE INVENTION

[17] The general concept of a light fixture is known in the art. Generally, a light fixture is adapted to receive electrical power and is configured to accept a light source and power the light source when power to the fixture is turned on. Thus, when installed and turned on, the light fixture operates to activate a light source so as to provide illumination. Figure 1 depicts a perspective view of an exemplary embodiment of a light fixture representative of the present invention. As depicted, a light fixture 50 is supported by a hanger 60 that is mounted to a bracket 70. Thus, the light fixture 50 is mounted to some upper surface such as a ceiling, not shown, that can have a certain

reflective property. Preferably, the light fixture is about 12 inches from the reflective surface. Light emitted from the light fixture 50 can be used to illuminate a room where the light fixture 50 is installed. As can be readily appreciated and as would be known to those of skill in the art, numerous other methods for supporting the light fixture 50 are possible, thus the depicted method is illustrative.

[18] Figure 2 depicts an exploded view of the embodiment depicted in figure 1. The light fixture 50 comprises a light housing 140. As depicted, the light housing 140 supports the components of the light fixture 50 and can provide an attractive profile useful in ensuring aesthetic values of the room are maintained when the light fixture 50 is installed.

[19] As depicted in Figure 2, a light dispersion shield 130 is mounted to the light housing 140. The light dispersion shield 130 can allow light to radiate down through the light housing 140. Mounted to the light housing 140 beside the light dispersion shield 130 are a light reflector 120a and a light reflector 120b. As depicted, the light reflector 120a and light reflector 120b are mounted to the light housing 140 to provide symmetrical reflection of the light. A light source 110 is mounted to the light housing 140 above the light dispersion shield 130. In an embodiment, the light source 110 is a standard fluorescent light. The light source 110 has a first end 116 and a second end 117. A light shield 100 is mounted to the light housing 140 above light source 110. The light shield 100 can be fashion of any suitable material including steel, aluminum or various alloys or plastic. Preferably the shield material is strong enough to minimize deflection of the light shield 100 when installed. A metal shield can reflect the blocked light, thus minimizing wasted absorption of the light within the light fixture. In an embodiment, spacers (not shown) made of a suitable material such as nylon can be placed between the shield 100 and the light source 110 so as to prevent contact between the shield and the light source 110. As depicted, clip 99 is mounted on the slight shield 100 in four places and is used to help connect the light shield 100 to the light housing 140. In an alternative embodiment, clip 90 can be eliminated. As

there are numerous configurations for clip 99, the disclosed configuration is illustrative.

[20] Figure 3*a* depicts a plan view of the embodiment depicted in Figure 2. As depicted, the light shield 100 covers a portion of the light source 110, and also covers a portion of the light reflector 120 and the light dispersion shield 130. Thus, as depicted, a center of the light shield 100 is configured to rest directly above a centerline of the light source 110. As depicted, the light source 110 extends most of the internal length of the light housing 140 and the light shield 100 extends beyond the first end 116 and second end 117 of the light source 110.

[21] Figure 3*b* illustrates a front view of the embodiment depicted in figure 3*a*. As can be readily appreciated, light housing 140 has a thickness 145, as shown by the arrow. Reducing the thickness 145 of light housing 140 reduces the weight and the cost of light fixture 50. In addition, a decreased thickness 145 allows for installation of the light fixture in locations where the ceiling is relatively low, for example having a height of less than 10 feet. Thus, a decreased thickness 145 is valuable for making the light fixture 50 more presentable to individuals seeking a light fixture capable of providing indirect lighting.

[22] Figure 4*a* is a cross-sectional view of the embodiment depicted in Figure 3*a* along the lines 4-4. The cross-sectional view of Figure 4*a* also illustrates the intersection of a vertical plane with the light fixture 50. Light source 110 has a light center 111, shown as a point in Figure 4*a*, that extends along the longitudinal length of the light source 110 between the first end 116 and the second end 117. Thus, the vertical plane is transverse to the light center 111 extending the length of the light source 110. As depicted in Figure 4*a*, the light shield 100 has a shield center 105 and a first outer edge 104*a* and a second outer edge 104*b*. The light shield 100 can be further defined to have a first side 107, depicted as being located to the left of the shield center 105 and a second side 108, depicted as being located to the right of the shield center 105.

[23] As depicted in Figure 4*a*, the light shield 100 blocks a portion of the light emitted from the light source. The percentage of light blocked by the light shield 100 is greatest at the shield center 105 and decreases towards the outer edge 104*a* and outer edge 104*b*. Preferably, the change in the percentage of light being blocked is linear so as to minimize shadows or sudden changes in brightness on the reflecting surface. In an exemplary embodiment, the percentage of light blocked at the shield center 105 is 70 percent and this percentage decreases linearly to 0 percent at the outer edges of the light shield 100, thus providing a transition between the shielded area and the area not shielded.

[24] Figure 4*b* is a simplified view of Figure 4*a*. Using the light center 111 as a reference, light source 110 has a 180 degree axis 112 extending straight up, a 90 degree axis 113 extending to the right, and a 0 degree axis 114 extending straight down. Thus, the shield center 105 is directly over the light center 111 (i.e. the shield center 105 is on the 180 degree axis). A horizontal plane can be defined as containing a line extending along the light center 111 and also containing a line extending from the light center 111 along the 90 degree axis 113.

[25] Figure 5 depicts a partial plan view of the light shield 100. An inner aperture 103 is defined by an edge 205 at an angle 210, an edge 206 at an angle 211, an edge 207 at an angle 211, an edge 208 at an angle 210 and an edge 209 along the shield center 105. As depicted, an outer aperture 102 is defined as an edge 201 at an angle 216, an edge 202 at an angle 216, an edge 203 at an angle 216, an edge 204 at an angle 215 and the outer edge 104a. Both the inner aperture 103 and the outer aperture 102 are found on the first side 107 and the second side 108. As numerous other angles and shapes are possible, the depicted geometry is illustrative. For example, a curve with a varying slope could be used to define the inner aperture.

[26] The light shield 100, as depicted in Figure 5, has a saw-tooth like pattern. In an exemplary embodiment, the saw-tooth like pattern can be defined by a section 200 that repeats itself. The outer boundary of section 200 is defined by the edge 203, the

edge 204, the edge 201 and the edge 202. As depicted, an inner boundary of the section 200 is defined by the edge 205, the edge 206, the edge 207, the edge 208 and the shield center 105.

[27] As previously discussed, the light shield 100 has the first side 107, and the second side 108 and a length configured to correspond to the length of the light housing 140 and the light source 110. In an embodiment, the lengthwise position of each section 200 on a first side 107 of the light shield 100 is not symmetric about the shield center 105 with the lengthwise position of any section 200 along a second side 108 of the light shield 100. In an embodiment, every section 200 on the first side 107 is offset as compared to every section 200 of the second side 108. This offsetting of the location of the section 200 on the first side 107 versus the location of the section 200 on the second side 108 can provide for improved structural rigidity of the light shield 100. In an alternative embodiment, the geometry of the section 200 on the first side 107 is different from the geometry of the section 200 on the second side 108.

[28] As depicted in Figure 6, the inner aperture 103 and the outer aperture 102 are configured to allow light from the light source 110 to pass through the light shield 100. The inner aperture 103 has an initial non-blocking area at the shield center 105. The path 106*a*, shown by the arrow, has a first point 181 at the shield center 105, a second point 182 some distance along the path, a third point 183 at a position between the second point and the outer edge 104, and a fourth point 184 on the outer edge 104. As depicted, the non-blocking area of the inner aperture 103 increases at a linear rate along the path 106 between the first point 181 and the second point 182. The inner aperture 103 then decreases at a linear rate along the path 106 between the second point 182 and third point 183. The outer aperture 102 has a non-blocking area that increases at a first linear rate along the path 106 between the second point 182 and third point 183. The outer aperture 102 then increases at a second linear rate along the path 106 between the third point 183 and the fourth point 184. In an embodiment, the combined change in non-blocking area of both the inner aperture 103 and the

outer aperture 102 provides a linear increase of the non-blocking area from the shield center 105 to the outer edge 104. In an embodiment, the light blocking area of the light shield 100 decrease along the path 106*a* from the shield center 105 to the outer edge 104*a*. By using multiple apertures with varying edges, the light emitted from the light fixture can be controlled so as to avoid excessive bright spots being projected on the reflective surface. In addition, in an embodiment of the light shield 100 having the inner aperture 103 and outer aperture 102 as depicted in Figure 6, the structure rigidity of the light shield 100 can be improved as compared to less desirable embodiments.

[29] Figure 7 depicts a simplified partial plan view of the light shield 100 and the light source 110. The first path 106*a* can be defined as running from the shield center 105 to the outer edge 104a, the path 106a being parallel to the 90 degree axis 113. Along the path 106a a plurality of coverage zones can be defined.

[30] As depicted in Figure 7, a coverage zone 250 and a coverage zone 251 are shown on the first side 107. Coverage zone 250 is defined as extending the length of the shield 100 between the shield center 105 and a boundary line 255. Coverage zone 251 is defined as the area extending the length of the shield 100 between the boundary line 255 and the outer edge 104a. A coverage zone 253 and a coverage zone 254 are shown on the second side 108. The coverage zone 253 is defined as the area extending the length of the light shield between the shield center 105 and the zone boundary 256. The coverage zone 254 is defined as the area extending the length of the light shield 100 between the zone boundary 254 and the outer edge 104b.

[31] As depicted, the coverage zone 250, the coverage zone 251, the coverage zone 253 and the coverage zone 254 have the same width 252. The light blocking area can be defined as the percentage of area of the shield 100 in the coverage zone that blocks light. Preferably, the measurement of the percentage of area that blocks light is take in a plan view as depicted in Figure 7. Along the path 106*a*, the light blocking area of the coverage zone 250 is greater than the light blocking area of the coverage zone

251. Along the path 106*b*, the light blocking area of the coverage zone 253 is greater than the light blocking area of the coverage zone 254.

[32] In an exemplary embodiment, as depicted in Figure 8, three coverage zones 401, 402, and 403 are defined on the first side 107. Three coverage zones 404, 405, and 406 are defined on the second side 108. The coverage zone 401 is defined as the area extending along the length of the shield 100 between the outer edge 104a and a zone boundary line 410. The coverage zone 402 is defined as the area extending the length of the shield 100 between the zone boundary 410 and a zone boundary 411. The coverage zone 403 is defined as the area extending the length of the light shield 100 between the zone boundary 411 and the shield center 105. The coverage zone 404 is defined as the area extending the length of the shield 100 between shield center 105 and a zone boundary 412. The coverage zone 405 is defined as the area extending the length of the shield between the zone boundary 412 and a zone boundary 413. The coverage zone 406 is defined as the area extending the length of the shield between the zone boundary 413 and the outer edge 104b.

[33] As depicted, the six coverage zones 401, 402, 403, 404, 405, and 406 have the same width 452. The light blocking area of the coverage zone 403 is greater than the light block area of the coverage zone 402. The light blocking area of the coverage zone 402 is greater than the light blocking area of coverage zone 401. Likewise, the light blocking area of the coverage zone 404 is greater than the light blocking area of the coverage zone 405. The light blocking area of the coverage zone 405 is greater than the light blocking area of the coverage zone 406. Thus, the light blocking area of subsequent coverage zones, starting from the shield center 105 decreases along the path 106a. Likewise, the light blocking area of subsequent coverage zones, starting at the shield center 105, decreases along the path 106b. In an embodiment, the light blocking area of coverage zone 403 is equal to the light blocking area of coverage zone 404. In an alternative embodiment, the light blocking area of coverage zone 403 is not equal to the light blocking area of coverage zone 404. Preferably, however, the

light blocking area in coverage zones similarly situated is relation to the shield center 105 are approximately the same so as to reduce the appearance of shadows and to minimize unevenness in the light distribution.

[34] As can be appreciated, the width of the coverage zones decreases as the number of coverage zones increases. In an alternative embodiment, not shown, N coverage zones can be defined. The N coverage zones can be defined as having a width that approaches zero (i.e. for N coverage zones, the width is proportional to 1/N, thus as N becomes very large the width approaches zero). In an exemplary embodiment with the coverage zones defined as having a width approaching zero, the decrease in the light blocking area of the plurality of coverage zones is linear along the path 106*a* from the shield center 105 to the outer edge 104a.

[35] Regardless of the number of coverage zones, and the corresponding width of the coverage zones, the light blocking area of the coverage zone closest to the center 105 is preferably not 100 percent. Thus, a portion of the light emitted from the light source 110 can be permitted to pass through the light shield 100 along the 180 degree axis 112. As depicted in Figure 8, the light blocking area at the center 105 of the light shield 100 is 70 percent.

[36] In an embodiment, the light being emitted from the light fixture along the 180 degree axis 112 (i.e. a first positive light quantity) is a percentage of the maximum light emitted from the light fixture (a second maximum light quantity) at some second angle offset from the 180 degree axis 112 (i.e. between the 180 degree axis 112 and the 90 degree axis 113). The maximum light emission or maximum light quantity is typically known as the main beam. By increasing the light quantity being emitted from the light fixture through a range of angles from the 180 degree axis 112 to the angle of the main beam, a pleasing pattern of light can be shown on the reflective surface.

[37] In an embodiment, the first positive light quantity is some percentage of the maximum light quantity. Having less light emitted at the center than at some offset angle can allow the light fixture to be placed near the reflective surface without emitting distracting bright spots of light. In an embodiment, the first light quantity is not more than 40 percent of the maximum light quantity emitted at the main beam. In an alternative embodiment, the first light quantity is not more than 30 percent of the maximum light quantity. Decreasing the amount of light emitted at the center can allow for closer placement of the light fixture to the reflective surface. Naturally, the more compact the light fixture and the closer the light fixture can be mounted to the ceiling, the more suitable the light fixture is for low ceiling applications.

[38] The present invention has been described in terms of preferred and exemplary embodiments thereof. Numerous other embodiments, modifications and variations within the scope and spirit of the appended claims will occur to persons of ordinary skill in the art from a review of this disclosure.